IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Larson et al.

Application No.: 10/685,739

Filed: October 14, 2003

Title: UNIFORM ETCH SYSTEM

Attorney Docket No.:
LAM1P167X2/P1066X2

Examiner: Zervigon, Rudy

Group: 1763

Confirmation No.: 6129

DECLARATION UNDER 37 CFR 1.132

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

I, Dean Larson, declare as follows:

I am a co-inventor in the above-identified patent application.

I am a citizen of the United States of America

I received a BA degree from California Polytechnic State University, San Luis Obispo.

I have worked for Lam research Corporation from 1996 performing mechanical design and analysis of structural, thermal, materials, fluid and gas flow, and vacuum technology on semiconductor industry wafer dry etch and transport systems. I previously worked for Lockheed Missiles and Space from 1983 to 1996, providing the same service.

I have reviewed U.S. Patent No. 5,496,408 to Motoda et al. (Motoda) and U.S. Patent No. 6,315,858 to Shinozuka et al. (Shinozuka).

Our invention provides an apparatus for providing gas from a gas supply to at least two different zones in a process chamber that has a flow divider to divide gas to a plurality of legs. A master leg is connected to the flow divider and has a master fixed orifice. A slave leg is connected to the flow divider and has a slave leg valve and a first slave fixed orifice. The master and first slave fixed orifices are both flat plate fixed orifices.

Based on my expertise in the fields of mechanical design and analysis of the semiconductors and the structural, thermal, material, fluid, and gas flow properties thereof, I can affirm that one of ordinary skill in the art would recognize the term "flat plate fixed orifice" to mean an orifice, having an immovable flat plate such that the size opening created by the flat plate that is fixed at the time of manufacture and cannot be altered for the lifetime of the orifice. One of ordinary skill in the art would definitely know that an iris valve, like the one discussed in Shinozuka, could not be considered to be a flat plate fixed orifice because the size of the opening in the iris valve clearly can be altered by controlling the valve to open or close.

Furthermore, one of ordinary skill in the art understands that a flat plate fixed orifice has a perfectly round aperture owing to the fact that the plate is a single structure with a hole placed therein. As such, one of ordinary skill in the art would know that an iris valve could not be considered to be a flat plate fixed orifice because the opening in such a valve would not be perfectly round, owing to the fact that the hole is formed by the abutment of multiple plates that have the ability to move to make the hole larger and/or smaller.

Furthermore, one of ordinary skill in the art understands that a flat plate fixed orifice has a constant thickness at its aperture. As such, one of ordinary skill in the art would know that an iris valve could not be considered to be a flat plate fixed orifice because the aperture in such a valve would not have a constant thickness, owing to the fact that it is formed by the aforementioned abutment of multiple plates that have the ability to move to make the hole larger and/or smaller.

Furthermore, one of ordinary skill in the art understands that a flat plate fixed orifice has no repeatability error at the time of operation, owing to the fact that the plate is fixed at the time of manufacture and cannot be moved. As such, one of ordinary skill in the art would know that an iris valve could not be considered to be a flat plate fixed orifice because each time the iris valve opening size is adjusted to another size, and then back to the same size, there is an associated set point tolerance error from the drive mechanism. This is commonly referred to as a repeatability error. This error correlates directly to a flow error of the iris valve opening. The iris valve is rarely at the same opening size for any given set point, upon previously operating at another opening size. To address such a repeatability error, systems commonly rely on an additional closed loop control system to improve, but not eliminate such a repeatability error. Either of these architectures are inferior to the flat plate fixed orifice equipment architecture, due to the additional expense of the control system and still the inferior repeatability error system performance.

Furthermore, one of ordinary skill in the art understands that a flat plate fixed orifice lacks any control mechanisms, such as control lines running to it that send electrical impulses or signals to power and or control the opening or closing of the valve. This is, of course, because a flat plate fixed orifice cannot be opened or closed, so having such control mechanisms would make no sense.

Furthermore, one of ordinary skill in the art clearly understands that the required system configuration for utilizing flat plate fixed orifices in a dual zone output gas splitter of using one master orifice, and two or more slave orifices wouldn't apply to a system utilizing an iris valve. Instead it would easily be recognized that a dual zone output gas splitter system utilizing an iris valve would only require one master fixed plate orifice, and one slave iris valve. This would, of course, make the currently claimed hardware configuration an entirely different architecture, which would be inferior in performance to the currently claimed system architecture, due to the aforementioned arguments. The same claim can be similarly made to multiple zone output gas splitters of three or more zones.

Additionally, it would not have been obvious to one of ordinary skill in the art to combine the iris valve on Shinozuka with the apparatus of Motoda, because doing so would not make sense. The movable parts that allow the iris valve of Shinozuka to open or close would cause the plates in the valve to rub against each other, which would introduce particle contaminants that would damage the wafer substrate surface in a wafer dry etch process of small feature sizes. Similarly, the fact that the iris does not have constant thickness at its aperture or a truly round hole makes gas flow unpredictably and differently than a flat plate fixed orifice, making the flow through such a valve analytically unpredictable as compared to a flat plate fixed orifice. Similarly, the movable nature of the iris valve also introduces repeatability error, at the same set point opening size. And similarly, the entire system architecture would make no sense when an iris valve is substituted for a single fixed plate orifice. As a co-inventor of the present application, I realized that an iris valve would have the above limitations and therefore chose to create an apparatus that included only flat plate fixed orifices so that the movable parts would be eliminated, thus reducing particle contamination and increasing predictability and repeatability to the system, and reducing overall system cost and increasing overall system reliability.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true. I further declare that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both (under Section 1001 of Title 18 of the United States Code), and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Dean Larson

Dean Larson

12-19-2008

Date